

## 2.2 Analyze Conditional Statements

Conditional statements are logical statements with two parts. When written in the *if, then* form, the "if" part contains the hypothesis and the "then" part contains the conclusion.

If p, then q.      p-hypothesis      q-conclusion

$p \rightarrow q$       "if p, then q" or "p implies q"

### Examples:

If Cinderella completes her chores, then she can go to the ball.

If an angle is a right angle, then it measures  $90^\circ$ .

If a polygon has exactly 6 sides, then it is a hexagon.

Hypothesis      Conclusion

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### Examples:

All squares are rectangles.

If it is a square, then it is a rectangle.

All cats are animals.

If it is a cat, then it is an animal.

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## Related conditionals

Negation-opposite meaning as well as opposite truth value  
(Symbol  $\sim$ )

Conditional	$p \rightarrow q$
Converse	$q \rightarrow p$
Inverse	$\sim p \rightarrow \sim q$
Contrapositive	$\sim q \rightarrow \sim p$

(negates original)  
(negates converse)

If a conditional is true, then the contrapositive must also be true. They are said to be logically equivalent. The same is true for the converse and the inverse.

Example: Put the following statement into the if, then form. Write each related conditional. Determine whether it is True or False. If false, provide a counterexample.

Example:

All birds are owls.

Conditional:

If it is a bird, then it is an owl.

False (Robin)

Converse:

If it is an owl, then it is a bird.

True

Inverse:

If it is NOT a bird, then it is NOT an owl.

True

Contrapositive:

If it is NOT an owl, then it is NOT a bird.

False (Robin)

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Example: Write each related conditional. Determine whether it is True or False. If false, provide a counterexample.

If two angles form a linear pair, then they are adjacent angles.

Conditional: If 2  $\angle$ s are adjacent, then they form a linear pair.

Converse: If 2  $\angle$ s do not form a linear pair, then they are not adjacent.

Inverse: If 2  $\angle$ s are not adjacent, then they are not a linear pair.

Contrapositive: If 2  $\angle$ s are not a linear pair, then they are not adjacent.

Example:

All whales are mammals.

Conditional:

Converse:

Inverse:

Contrapositive:

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Biconditional Statement--conjunction of a conditional and its converse

iff "if and only if"

Example:

- T If a quadrilateral has 4 right angles, then it is a rectangle.  
T If a quadrilateral is a rectangle, then it has 4 right angles

A quadrilateral has 4 right angles iff it is a rectangle.

## 2.3 Apply Deductive Reasoning

Deductive Reasoning--use facts, rules, definitions, properties, or the laws of logic to reach logical conclusions

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Example:

If 2 angles are vertical, then they are congruent.

a. Given:  $\angle 1$  and  $\angle 2$  are vertical

Conclusion:  $\angle 1 \cong \angle 2$

b. Given:  $\angle 1 \cong \angle 2$   $\angle 3 \cong \angle 4$

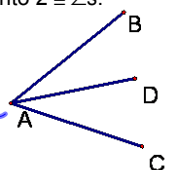
Conclusion: No concl. possible

Example:

If a ray bisects an angle, then it divides it into  $2 \cong \angle$ s.

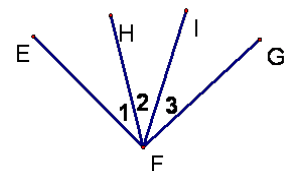
a. Given:  $\overrightarrow{AD}$  bisects  $\angle BAC$

Conclusion:  $\angle BAD \cong \angle DAC$



b. Given:  $\angle 1 \cong \angle 3$

Conclusion: No valid



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Example:

If a figure is a rectangle, then opposite sides are congruent.

a. Given: ABCD is a rectangle

Conclusion:

b. Given: MNOP is a valid trapezoid

Conclusion:

c. Given: Figure RSTU;  $RS = TU$ ,  $ST = RU$

Conclusion:

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Examples of Law of Detachment

Law of Detachment--If  $p \rightarrow q$  is true, and  $p$  is true then  $q$  is true.

Law of Syllogism  
If  $p \rightarrow q$  and  $q \rightarrow r$   
then  $p \rightarrow r$ .

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Different type of reasoning.

Example:

Given:  $\overline{WX} \cong \overline{UV}$ ;  $\overline{UV} \cong \overline{RT}$

Conclusion:  $\overline{WX} \cong \overline{RT}$

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Example:

(1) If Casey gets to bat, then he will get a hit.

(2) If Casey gets a hit, then we will win the game.

(3) If Casey gets to bat, then we will win the game.

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These are examples of the Law of Syllogism

If  $p \rightarrow q$ , and  $q \rightarrow r$  are true, then  $p \rightarrow r$  is true.

HW

p82-83

#s 1, 7, 11-15, 19, 20

p90

#s 4, 5, 7, 9, 12, 13, 15

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